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ABSTRACT

This paper proposes a way to organize the literature on cognitive and learning styles that avoids the shortcomings of existing taxonomies. Most existing reviews and organizations of literature in the field can be criticized on the basis of inconsistency, selectivity, lack of scientific criteria, failure to consider scientific impact, bias, and lack of context. Citation analysis is suggested as the methodology for developing an alternative organization. Citation analysis is a quantitative research approach based on the use of the citation indexes. The approach generally uses two measures of scientific activity: citation rates of authors, documents, and journals, and the number of citation links between authors, documents, and journals. In this study, citation analysis was used to develop a taxonomy of cognitive and learning style by examining records from the Social Science Citation Index (online) from 1972 through the present. Searches for cognitive style and learning style yielded a combined file of all entries on both terms since 1972. Data were analyzed with Bibexcel, a tool for manipulating bibliographic data, to cluster co-citation pairs. The different organizations of the data were combined to an overall structure, represented visually by a figure that supports three general conclusions about the cognitive and learning style research. This research differs greatly at quantitative and qualitative levels. It identifies what both fields have in common: the heritage of H. Witkin, and as a third conclusion, it can be seen that additional conclusions can be drawn when the variety of models within both fields is considered. An appendix lists references contained in the alternative organization of the field. (Contains 7 tables and 37 references.) (SLD)

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A Critical Review of the Cognitive and Learning Style Literature Through Citation Analysis

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A Critical Review of the Cognitive and Learning Style Literature Through Citation Analysis

Since the beginning of the 50's, the research on cognitive and learning style is generating an impressive amount of publications, and since the "rediscovery" of these concepts in the eighties (Riding & Cheema, 1991), this amount keeps increasing.

But does quantity always equals quality? For these research fields, the question is open to doubt. Furnham (1995) complains about this in the following way:

> Rather than a slow and gradual emergence of an experimental paradigm and the formulation of explanatory models and concepts, we have witnessed the opposite: a balkanization of the field, with researchers developing highly similar eponymous constructs that often overlap. (p. 411)

Different theorists have been working with different models and measuring-instruments that claim to describe or measure "the" cognitive or "the" learning style concept (Riding & Cheema, 1991). At least 125 such models are used in the scientific and popular literature. In addition, the two concepts are often used as synonyms (Sadler-Smith, 2001).

Recently, a tendency toward an integration of theories is growing (Rayner, 2000). From different perspectives, attempts to organize and to reduce the current plenty have been presented (Curry, 1983, 1987, 2000; DeBello, 1990; Dunn, R., DeBello, T., Brennan, P., Krimsky, J., & Murrain, P. , 1981; Furnham; 1995; Grigorenko & Sternberg, 1995; Guild & Garger, 1998; Hanson, 1988; Jonassen & Grabowski, 1993; Miller, 1987; Riding & Cheema, 1991; Rayner & Riding, 1997; Riding & Rayner, 1998; Rayner, 2000; Schmeck, 1988; Sternberg & Grigorenko, 1997, 2001).

This study tries to move beyond these earlier attempts. Building on a number of shortcomings of the existing taxonomies, the question will be raised for an alternative organization of the cognitive and learning style literature. This alternative organization should meet specific requirements that help to meet the criticisms. Citation analysis will be explored as the potential methodology to generate this alternative organization.

IN SEARCH OF AN ALTERNATIVE ORGANIZATION OF THE FIELD

Criticism of the Existing Taxonomies

We can not deny that the existing reviews and organizations are suitable for a first orientation in the cognitive and learning style literature. Nevertheless, the different approaches reflect a number of shortcomings. In-depth study and comparison of the taxonomies of Curry, Miller, Grigorenko & Sternberg, Riding et al., and Jonassen & Grabowski reveal some general points of criticism.

1. Inconsistency

When the taxonomies are examined in relation to one another, the general picture does not become transparent. Intuitively, relations between the different categorizations can indeed be somehow appreciated, but not really unambiguously established. It is e.g., not always easy to map the taxonomies on one another.

2. Not exhaustive

The authors are selective in the models they include; they do not give exhaustive overviews of the available literature of that date. The taxonomies therefore do not seem to cover all existing conceptualizations of cognitive and learning style.

3. No clear distinguishing criteria

When we try to situate "newly discovered" style models in the available taxonomies, this seems hard to do. The criteria the different authors use to define their distinct categories are often less clear. They usually give only a general description and a few exemplary style models to help the reader, and this information is insufficient.

4. No consideration of differences in scientific impact

The authors presenting a taxonomy include very different style models. But they do not take into account the differences in scientific impact of these individual models. The taxonomies consider all the models to articulate the same scientific value. But, it is well known that some style models have a larger influence in the field than others. This is in no way expressed in the available taxonomies.

5. Bias

The former weaknesses reflect a central point of criticism: bias. Each author of a taxonomy looks at the field of style research from his/her own point of view. What Kreuzman (2001) states about the establishment of intellectual traditions in philosophy, can easily be translated to the categorization of cognitive and learning style models:

> . . . it is usually done in a variety of informal ways, for example, by interpreting the writings of the relevant individuals and by looking at the focus and the tone of the work. Although such approaches are useful, they are subject to the biases of the individual doing the classification. The resulting classification may reveal more about the person doing the analysis than the writings being examined. (p. 527)

The taxonomies of Curry, Miller, Riding et al., and Jonassen & Grabowski all take an a priori conception about the field of cognitive and learning style as their starting point. They also pass judgments about the relationships within and between the categories they discern. Hypotheses about these relationships are as important as the categorization in itself. This explains to a large extent why the categorizations are inconsistent when compared to one another.

6. No context

The fact that only limited information is given about the "context" of the individual models in the taxonomies is an additional shortcoming. With the exception of the taxonomy of Grigorenko & Sternberg, hardly reference is made to the individual researchers' motivation, their specific theoretical background, their position in the scientific community,...(Sanders & Van Rappard, 1982).

Requirements for an Alternative Organization

This study attempts to organize the cognitive and learning style literature in a way that avoids the shortcomings raised in relation to the existing taxonomies. In other words, the alternative organization has to fulfill the following requirements:

1. Unambiguous: The organization has to be unambiguous. The position of individual publications, authors, and style models has to be transparent and not confusing to the user of the organization. Requirements 2, 3, and 5 will also contribute - more or less - to this requirement.
2. Exhaustive: The organization has to present an exhaustive overview. It has to aim at including all the cognitive style and learning style literature.
3. Clear distinguishing criteria: The criteria used to define distinct categories of publications, authors, and style models have to be clear and explicit. As a consequence, the organization will be more readily usable for further exploration of the cognitive and learning style literature.
4. Scientific impact is taken into account: The organization has to consider the relative scientific impact of the individual publications, authors, and style models.
5. Objectivity: The organization has to reveal the structure of the research on cognitive and learning style, independent of the assumptions of the developer of the organization.
6. Information about the context: It has to be possible to take into account the context of discovery of the various cognitive and learning style models as reflected in the style literature.

In the remainder of this study, *citation analysis* will be put forward as the methodology to develop an alternative organization. We will discuss its capability to meet the requirements mentioned above, and put it to a test by applying the methodology to the cognitive and learning style literature, published since 1972.

CITATION ANALYSIS OF THE COGNITIVE AND LEARNING STYLE LITERATURE

Methodology

Citation Analysis: a General Introduction

Citation analysis is a quantitative research approach based on the use of the citation indexes. Such indexes are being developed by e.g., the Institute for Scientific Information. Two measures of scientific activity are generally used in citation analysis: (1) *citation rates* of authors, documents, and journals and (2) the number of *citation links* between authors, documents and journals (Garfield, 1979).

Citation Rates

The citation rate of a given author, document, or journal equals the number of times individual scientists cite this author, document, or journal in their own work. It is seen as an objective measure for evaluating the research performance of specific individuals or groups.

The validity of this practice is nevertheless heavily criticized by the scientific community (Garfield, 1979; Hauffe, 1994; Kostoff, 1998; MacRoberts & MacRoberts, 1996). A selection of the objections most often raised, is listed in the left column of Table 1. They all boil down to the conclusion that the process of citation in itself is not entirely free from subjective, biased practices.

Those who advocate the use of citation rates do not deny these criticisms. They admit that the use of citation data for evaluation purposes is not simple. They stress the fact that these indexes have to be used with care. As Garfield (1983) states: "Citation analysis is not a shortcut to be used as a replacement for thinking." (p. 371). In the right column of Table 1 a list of methodological and interpretive guide-lines is listed to appraise citation rates in a responsible and fair way to guarantee optimal objectivity of the citation analysis (Kostoff, 1998; Garfield, 1979; Phelan, 1999).

Next to the criticisms summarized in Table 1, there is also the question whether citation rates inform us about the *importance*, *significance*, *impact*, *utility*, *usefulness*, *quality*, *persuasive power*, *recognition*, or *influence* of a particular author or publication?
Garfield (1979) is clear about this issue:

> The only responsible claim made for citation counts as an aid in evaluating individuals is that they provide a measure of the utility or impact of scientific work. They say nothing about the nature of the work, nothing about the reason for its utility or impact. (p. 246)

Although validation studies have indicated that high citation rates correlate with peer judgments of scientific excellence, they cannot be used as a single measure of scientific quality (Garfield, 1979). But they help to introduce an objective element into a more general evaluation process (Phelan, 1999).

For the study of the social sciences and the humanities, as is the case in the present study, Garfield (1979) also proposes to use – in addition - the number of documents in which a specific author is cited. Because it is common practice that authors accumulate several citations per article, this measure could give a more accurate indication of the impact of their work, next to the traditional citation rates.

In the context of the present study, both citation rates and the number of citing documents are of use. They help to meet the fourth requirement. They also help to increase the objectivity of the organization process and help to take into account the context (five and six).

Citation Links

Citation links between authors, documents or journals build on *co-citation coupling*. The basic assumption of this operation is that if two authors, documents or journals are cited together in a third document, they are considered as related to one another by a shared intellectual focus (Garfield, 1979).

Co-citation analysis, the study of these citation links, was introduced in the seventies by Small (1973). Within the sociology of science, it was developed as a method to define in an objective way the intellectual structure of a scientific field. The main hypothesis was that science is made up of a *structure of specialties* that can be uncovered by organizing the authors, papers or journals into clusters and by showing the relationships between these clusters (Garfield, 1979). A pilot study of Small & Griffith (1974) proved this to be possible. Together with the development of this co-citation clustering, various techniques to visualize the results emerged. In a recent article, Small (1999) reviews the successful evolution of these citation mapping techniques.

In contrast to the study of citation rates, the study of co-citation links generates relatively little comment from the scientific community. Only within the sociology of science itself, some have treated the technique with skepticism. Edge (1977) e.g., listed six reasons why co-citation analysis does not fit in his conception of "doing the sociology of science". Since his approach is – a priori - a qualitative one, his critique is not surprising. It reflects the generic tension between qualitative and quantitative scientists. Also the critique of MacRoberts & MacRoberts (1996) focused in the first place on the basic assumptions of citation analysis. These authors prefer a qualitative study of science. Instead of pursuing objectivity by studying large sets of formal, quantifiable co-citation relationships, they want to understand the informal communication between individual scientists, their motives and intentions, and so forth.

The present study explicitly builds on the basic assumptions of co-citation analysis. It is considered as a method to organize in an alternative way the cognitive and learning style literature. Moreover, it is projected as an approach that will result in an organization that meets the six requirements put forward earlier in this paper. It is expected to result in an unambiguous classification, based on clear distinguishing criteria and objective analysis, taking into account the impact of individual contributions and respecting the scientific context of the literature. Moreover, the organization is presented as exhaustive. The latter is made possible by including in the co-citation analysis all the articles found in recent citation indexes.

Design

Sample

Citation data are the base for this study and build on records from ISI's *Social Science Citation Index* (SSCI 1972-present), provided on-line through the Web of Science. Two queries were carried out in this database. A first query was based on the keywords "learning style", which resulted in 349 records. A second query used the keywords "cognitive style" with a result of 866 records. All the records were saved into two separate text-files. The combination of the two files resulted in a third text file that comprised all the literature about both cognitive and learning style since 1972.

Research Questions

Two sets of research questions directed the citation analysis. The two sets each reflect a perspective from which the citation data can be studied.

The first perspective limits itself to the publications since 1972 and the way these publications refer to one another. This perspective is called "the present" since the analysis is limited to an analysis of the literature of the last thirty years.

The second perspective takes the publications since 1972 as a starting point and does not only look at the way the authors refer to one another, but also to the way they refer to other, also earlier, authors. In this way the "foundations" (founding references) of the cognitive and learning style literature can be researched. Figure 1 gives a graphical representation of these two perspectives.

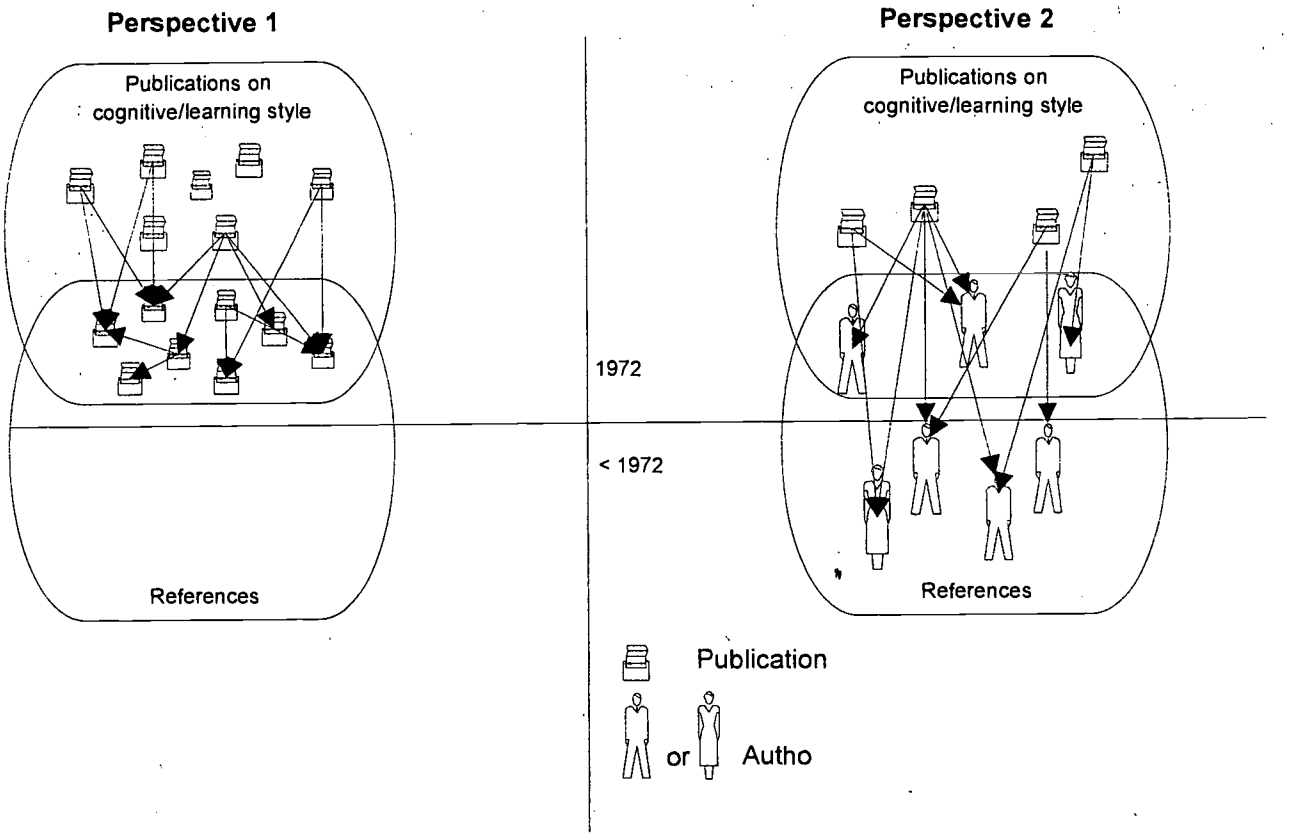


Figure 1. Perspectives in co-citation analysis.

To orient the reader, we present labels that will help to distinguish between the four research questions that build on the two perspectives.

1. Perspective 1: the present, the publications on cognitive and learning style since 1972.
   a. Who are the most active authors in this research area (PR-MAA)?
   b. Clustering of co-cited documents: How many times are publications cited together by a third publication and on the basis of these co-citation data, how can the publications be clustered (PR-DOCCC)?
2. Perspective 2: the foundations, the authors cited by the cognitive and learning style literature since 1972.
   a. Who are the most cited first authors (F-MCFA)?
   b. Clustering of co-cited authors: Which first authors are cited together in the cognitive and learning style literature since 1972 and on this basis, how can these authors be clustered (F-FACCC)?

The answers to these questions will - at each level - result in the construction of an alternative organization of the literature.

Procedure

The two clusters of research questions will be applied separately in relation to the three data files: the *cognitive style* data, the *learning style* data, and the *master file* that combines all the literature.

In relation to Perspective 1, co-citation analysis will use the publication as a unit of analysis. As to Perspective 2, the analysis will use the first name mentioned as an author in the article. This is due to

limitations of the research tool used. This will not cause any interpretation difficulties, since author co-citation clustering is closely related to co-cited document clustering (McCain, 1990).

Data Analysis

The data were analyzed using Bibexcel, a tool-box for manipulating bibliographic data, developed by Olle Persson from the Inforsk research group at Umeå University, Sweden (Persson, 2001). The software package enables to import records from database queries, and to convert and analyze them. The analysis results are saved in files that can be further analyzed with Excel or SPSS.

The Bibexcel software follows a very specific procedure to cluster co-citation pairs of publications or authors. This hierarchic clustering routine is referred to as the *Persson's Party Clustering* and can be described using the metaphor of "the pairs are invited to a party" to explain the chain of events.

Imagine you have the following list of (co-citation) pairs:

10	A	B
9	D	F
8	B	C
7	A	C
6	F	G
5	H	I

The clustering routine will follow the subsequent chain of events.
The pair A-B enters the building first, they have to wait in the hall;
D-F comes next, they also have to wait in the hall;
B-C comes next, forms a cluster with A-B and this first cluster enters the ballroom;
A-C comes next, will be deleted since A-C is already in the ballroom;
F-G comes next, there are yet no friend(s) in the ballroom;
The pair goes to the hall and finds D-F and
Now D-F-G forms a cluster and enter the ballroom;
H-I comes next, the pair has to wait in the hall;
A-H comes next, H wants to cluster with A-B-C (already in the ballroom) but
searches the hall and finds H-I;
I will consequently cluster with A-B-C-H;
All pairs have arrived.
The final outcome of this clustering procedure is:
Cluster 1 holds A-B-C-H-I;
Cluster 2 holds D-F-G.

In the result tables below, the clusters will always be presented in the order they resulted from the clustering procedure. This order does not express characteristics like size or relative impact. In relation to each cluster, the tables show the cluster size (number of documents or authors) and the concrete references of the central documents. The list is – due to a lack of space - always limited to the documents or authors that appear with the highest number of co-citation links. The complete analysis results can always be obtained from the authors. In the last column, a description of the cluster is given, based on the titles, abstracts, and references of the documents in this cluster. As a rule, this description indicates what cognitive or learning style model is being used in relation to concrete variables, and/or in what context.

Finally, also the publication year(s) of the central documents is given. This is an indication of the period the cluster came into existence. This however does not express the actual state of these clusters: whether they continue to develop or whether they are to be considered as historical clusters.

Results and Discussion

Perspective 1- The Present: Publications on Cognitive and Learning Style Since 1972

a. Most Active Authors (PR-MAA)

The data in Table 2 indicate the authors that have been most active during the past 30 years in the field of cognitive and learning style research.

It has to be noted that *publishing frequencies* are not equal to citation rates. These publishing frequencies only measure the amount of output authors produce, or their activity. This is not to be confused with *impact* (Phelan, 1999).

A first striking observation, in relation to Research Question 1a, is that there is almost no overlap between the PR-MAA in the field of cognitive style and the PR-MAA working on the learning style topic. There are only two exceptions. (1) Sadler-Smith publishes mainly about cognitive style, but two (and a half) of his works on cognitive style also deal with learning style. (2) Riding does also focus on cognitive style, but in addition he has published one (and a half) publication on learning style (not in list, number 24). The fact that the research of both authors is explicitly linked to an educational setting, probably explains their appearance in both research areas.

Another remarkable observation is that the publication frequency of the PR-MAA working on the learning style topic is clearly lower than that of PR-MAA publishing about cognitive style. There are different explanations for this. First of all, it is possible that the learning style authors are indeed less active. Secondly, it is possible that they publish more as a team, resulting in lower individual publication frequencies. Another assumption is that research on learning styles gets published less easily in the journals included in the Web of Science. This might suggest more difficulties to sustain peer evaluation than publications about cognitive style.

b. Document Co-Citation Clustering (PR-DOCCC)

As explained earlier, a specific clustering procedure was followed to construct the clusters in this analysis. We also repeat that the analysis is repeated for each of the three data files.

Cognitive style file

PR-DOCCC of all the publications on cognitive style resulted in 16 clusters, from different sizes; 211 publications belong to a specific cluster (see Table 3).

The 16 clusters represent an alternative organization of the literature. This organization represents the specialties that have developed in the cognitive style research of the past 30 years. The 655 documents not incorporated in one of these clusters either have not been cited at all by the cognitive style literature since 1972, or haven't been co-cited within this literature. Knowing that a majority of university academic staff never receive as many as three citations in their whole career (Phelan, 1999), the first alternative seems a plausible explanation.

What can now be concluded in reply to Research Question 1b?

First of all, one can observe that of all the cognitive style models that have been developed, only a few are intensively used: those of Witkin, Schroder, Riding, Allinson, Kirton, Kagan, and Pettigrew. The largest cluster of publications on cognitive style builds on Witkin's "field dependency - field independency model". It is clearly the most influential model.

Also apparent is the variety of contexts in which cognitive style is used: from research about dream recall, over political psychology to the development of marketing strategies. Some of these specialties are indeed restricted, but the fact that they appear in independent clusters indicates that they

are at least clearly discernable. When we look at some of the larger clusters (3, 5, 6), "learning" and "education" seems to be the important application field.

Learning style file

PR-DOCCC of all the publications on learning style, reveals 7 prominent clusters, including 117 of all 349 publications in the sample (see Table 4).

These 7 clusters represent the specialties that have developed in the learning style research during the last 30 years. In response to Research Question 1b, some interesting observations can be made.

First, there seem to be two sorts of clusters appearing from the PR-DOCCC. On the one side, clusters in which a specific learning style model or instrument is the pivot on which everything turns. On the other hand, clusters for which it is not so much the kind of learning style that unites all publications, but the context and the variables in relation to which various models are applied. Figure 2 gives a graphical representation of this alternative organization.

Figure 2.. PR-DOCCC learning style.

A second observation is again that despite the abundance of learning style models developed, only a few are really actively used: those of Kolb, Honey & Mumford, the approaches to learning models, and the Dunn & Dunn model. Kolb's Learning Style Inventory is in this context apparently the most influential learning style instrument, with 59 related documents. Dunn & Dunn's Learning Style Questionnaire plays a distinguished role in Clusters 4, 5, 6, and 7. It is probably the second most influential instrument in the field of learning style, next to Kolb's.

Finally, it is interesting to compare the publication year of the central clusters in the analysis of cognitive style versus learning style documents. For the cognitive style research field, there are clusters that clearly already came into existence in the seventies, while for the learning style research, the various specialties only started developing at the beginning of the eighties. The PR-DOCCC reveals that the cognitive style research field is in general older than the research into learning style.

Master file

The application of the same PR-DOCCC procedure to the *master file* of cognitive style and learning style publications, resulted in eighteen clusters, of which twelve have already been identified in the analyses above.

From the *cognitive style* analysis, Clusters 1, 2, 4, 5, 6, 10, 14, and 16 reappear, and from the *learning style* analysis, Clusters 1, 2, 3, and 5 can be observed again. Their numbers are printed in bold in the tables above. During the previous analyses, these clusters appeared to be rather large and fairly easy to label. The fact that they now prove also to be discernable in the larger master file, is an indication of the reliability and validity of this alternative organization.

Eight clusters from the *cognitive style* analysis do not reappear, and three clusters from the *learning style* analysis are also left out. Six new clusters appear. The most obvious explanation for this fact, is that these – either fairly small or indefinite - clusters exist rather as an artifact of the clustering procedure used.

Perspective 2 - The Foundations: the Authors cited in the Cognitive and Learning Style Literature Since 1972

a. Most Cited First Authors (F-MCFA)

The F-MCFA of the cognitive style literature and the F-MCFA of the learning style literature are listed in Table 5.

These data provide an answer to Research Question 2a. As such, they put forward the authors whose work is apparently fundamental for the cognitive and learning style research field.

We will base our interpretation of these results first on the citation rates; next on the number of documents that cite these authors. The latter helps to judge more accurately the impact of an author. For example, when two authors have the same citation rate (see Riding and Entwistle in the *learning style* sample), the number of documents citing these authors indicates how many documents account for these citation rates. This gives additional information to judge the importance of the authors. In the example, Entwistle's impact on the learning style literature is clearly much wider than Riding's.

The first thing to be derived from Table 5 is that there is again little overlap between both lists. Authors much cited in both research areas are e.g., Witkin, Riding, Myers, and Eysenck. About Witkin and Riding, can be said, also building on the previous analyses, that these authors developed concepts defined as cognitive styles that mainly have been applied in the context of learning and instruction. This explains their re-appearance as key authors in the learning style literature. Myers' and Eysenck's dual influence is of different kind. Both authors developed a personality inventory that apparently inspired the research on cognitive style literature as well as the research on learning style.

When the lists of the 55 most cited authors based on number of citing documents are compared, the number of overlapping authors increases: Witkin, Riding, Kolb, Myers, Eysenck, Piaget, Cronbach, Cattell, and Jung. A salient feature is that the latter six generally have a higher ranking in the *cognitive style* list than in the *learning style* list. Although they apparently have influenced both research fields, these "classics" on cognition, intelligence, and personality have a relatively wider impact on the cognitive style literature than on the learning style literature.

A second observation is that, for the publications on cognitive style as well as for the publications on learning style, there are a number of authors appearing both in the PR-MAA list (Table 2) and in the F-MCFA list. This is not surprising. When authors publish a lot, they get cited more easily. This might also suggest that these authors are active contemporary researchers that already have a considerable impact on the research field. Their names are marked with an asterisk (*) in Table 5. A significant feature of these authors in the learning style column, is that half of them write mainly about Kolb's Learning Style Inventory (*). This, and also the result of the PR-DOCCC (Table 3), is early evidence of a fact that is again confirmed by the F-MCFA results: Kolb's learning style model is the most influential in the field. 49% of all documents in the *learning style* sample have cited Kolb at least once.

Almost all other authors identified via PR-DOCCC as having a considerable impact, also get their position confirmed by the F-MCFA list in Table 5.

In the learning style research, Dunn indeed appears as the second influential. Vermunt and other authors from the "approaches to learning tradition" (e.g., Entwistle, Biggs, Marton, and Pask), as well as Honey, also seem to have the impact that can be expected from Table 3.

For the field of cognitive style research, the results in Table 5 confirm the chief impact of Witkin's model: 39% of all documents in the *cognitive style* sample cite Witkin at least once. Kagan, Kirton, and Riding are likewise confirmed as important authors, but with a citation rate about three times lower. Schroder, identified as a central author in cluster 2 of Table 3, doesn't reappear in the F-MCFA list. However, Tetlock does, and he is the most important author building on Schroder's model. Apparently, the way he uses it in political psychology has established a new research tradition. Authors not reappearing are Allinson and Pettigrew.

b. *Author Co-Citation Clustering (F-FACCC)*

This approach is based on the clustering of author co-citation pairs. Its logic is comparable to the one adopted in the PR-DOCCC. Tables 6 and 7 show the number of authors in each cluster and the names of the central authors. The title and publication year of their most cited publications are added. This helps to explain why particular authors appear in the same cluster. We also repeat that only the first authors of a publication with co-authors are considered in the analysis.

Cognitive style file

F-FACCC of the authors cited by the cognitive style literature during the last 30 years, results in 6 clusters of very different size. Only the 337 authors with citation rate of 10 or higher were included in the analysis. 203 of these authors belong to a specific cluster, as shown in Table 6.

Following the basic assumptions of co-citation analysis, these six F-FACCC clusters can be seen as representing the intellectual structure of the literature since 1972. In answer to Research Question 2b, they present the research specialties in the foundations of the cognitive style literature.

A first observation is that, when the F-FACCC results above are compared with the PR-DOCCC results in Table 4, five of the F-FACCC clusters can be indicated as being the foundation of PR-DOCCC clusters. These F-FACCC → PR-DOCCC relationships are indicated between parentheses in Table 6.

Second, F-FACCC Cluster 1, the largest cluster, is less differentiated than could be expected from the PR-DOCCC results in Table 3. One would expect Kagan and maybe Riding to be central authors of a separate F-FACCC cluster. Instead, they – as well as more than a third of the first authors included in the analysis - form part of the cluster evolving around Witkin. Possibly, this is a ceiling effect caused by the fact that 39% of all documents in the *cognitive style* sample have at least cited Witkin once (cf. F-MCFA in Table 5). As a consequence, other authors are easily cited together with Witkin. It is predictable that this large cluster will break up in different individual clusters if Witkin is excluded from the analysis.

The result of a F-FACCC, excluding Witkin, confirms this assumption. Cluster 1 breaks up into four sub-clusters. The previously discovered intellectual organization can thus be further refined. The first new and largest sub-cluster is centered around Kagan. Other central authors are Messick, Goodenough, Pascual Leone, and Oltman. The work of these authors is still closely related to Witkin's original conception of cognitive style. It focuses mainly on (developmental) characteristics of cognitive style in children and on the significance of cognitive style for learning.

In the second sub-cluster, the central author is Myers. Taking into account that also Jung is included, the cognitive style conceptualization of these authors is strongly determined by personality type theory.

The third sub-cluster centers on Kolb, but also Riding and Entwistle feature in the list. Their research focuses on pragmatic ways to use the style concept in an educational context. This is probably the reason why the authors of this cluster also re-appear in the *learning style* list of cited authors (see Table 5). A particular feature is that authors of review papers also are part of this sub-cluster.

The fourth and last sub-cluster shows Linn as the central author, together with Strawitz and MacLeod. These authors study the relationship between Witkin's field dependency - field independency and other formal cognitive abilities. At content level, there seems to be a relationship with PR-DOCCC Cluster 6.

Learning style file

F-FACCC of the first authors cited by the learning style literature resulted in two clusters (see Table 7) . Only the 95 first authors with a citation rate of 10 or higher were included in the analysis. 67 of these authors belong to a F-FACCC cluster.

Following the basic assumptions of co-citation analysis, these two F-FACCC clusters represent the intellectual structure of the learning style literature since 1972. In answer to Research Question 2b, they present the research specialties in the foundations of the learning style literature.

A first observation, after examination of affiliations of the authors, is that the authors in Cluster 1 are for the most part working in the US, whereas the authors included in Cluster 2 seem to form a distinct British-European research specialty in learning style research. The latter cluster is also most probably the foundation of the PR-DOCCC Cluster 3.

Secondly, and comparable to the F-FACCC analysis on *cognitive style*, the broad nature of the first cluster can be explained by a 'ceiling effect'. Because 49% of all documents in the *learning style* sample cite Kolb at least once (cf. F-MCFA in Table 5), it can be assumed that this cluster will break up when Kolb is excluded from the analysis. In this way, we can refine the organization of the learning style literature.

The result of a F-FACCC analysis, excluding Kolb, confirms this assumption. The "American" Cluster 1 breaks up into two major sub-clusters.

In the first cluster, Dunn is the central author, but also Myers, Witkin, Curry, and Gregorc are included. This sub-cluster therefore groups a variety of learning style models.

The second sub-cluster contains Freedman, Sims, Merritt, Veres, and Honey. This sub-cluster is more homogeneous, since the work of these authors is strongly affiliated with Kolb's learning style model. Knowing this, a relationship with PR-DOCCC Clusters 1 and 2 is probable.

Master file

The application of the same F-FACCC procedure to the *master file* of cognitive style and learning style publications generated a remarkable result. The *cognitive style* F-FACCC Clusters 2, 3, 4, 5, and 6 reappear in a comparable fashion, but the first cluster incorporates now also the original *cognitive style* F-FACCC Cluster 1 and all *learning style* F-FACCC clusters. This is not surprising, for *cognitive style* F-FACCC Cluster 1 contains a sub-cluster (sub-cluster 3) in which the core authors of both *learning style* F-FACCC clusters, Kolb and Entwistle, are represented.

Discussion: an Alternative Organization?

The aim of this study was to apply citation analysis to build up an alternative organization of the cognitive and learning style literature. The method indeed helps to reveal a variety of such an alternative organizations and an attempt to integrate the results will be presented in the following paragraph of this paper. In a second section conclusions will be drawn about the nature of the learning style and cognitive style research fields and their central concepts.

The Alternative Organization of the Cognitive and Learning Style Research

As was argued earlier in this paper, the different organizations can be combined and are mutually compatible. It is therefore possible to integrate the different organizations in one single overall structure. A visual representation of this structure is given in Figure 3.

- The top part of the figure represents the results of the analyses carried out in relation to the first perspective: the present.
- The bottom part represents the results of the analyses in relation to Perspective 2: the foundations of the research on learning and cognitive styles.
- Each quadrangle represents a cluster that resulted from the analyses. The surface of each figure shows its size.

- In addition, in the foundations part of the figure, the depth of the shades represents the relative impact of the clusters' central author, based on the F-MCFA results.
- The ~-sign has to be read as: "Research into cognitive or learning style, in relation to...".
- Between parentheses, the cognitive or learning style models that dominate in the clusters are shown.
- The "..." in the foundations part of the figure indicate that also other authors are part of the clusters.
- The dotted arrows between both parts of the figure reveal the relationships that are assumed between the F-FACCC and the PR-DOCCC clusters. The bold arrow represents the conclusion that Witkin's work is a central reference for practically all recent cognitive style research.
- The quadrangles touching the border between the "cognitive style" and "learning style" parts of the figure represent the literature in which both research fields meet each other.

It is furthermore to be stressed that Figure 3 – although complex in nature – does not depict the full set of results that came out of the citation analysis and have been described earlier in this paper.

General Conclusion

The Nature of the Cognitive and Learning Style Research

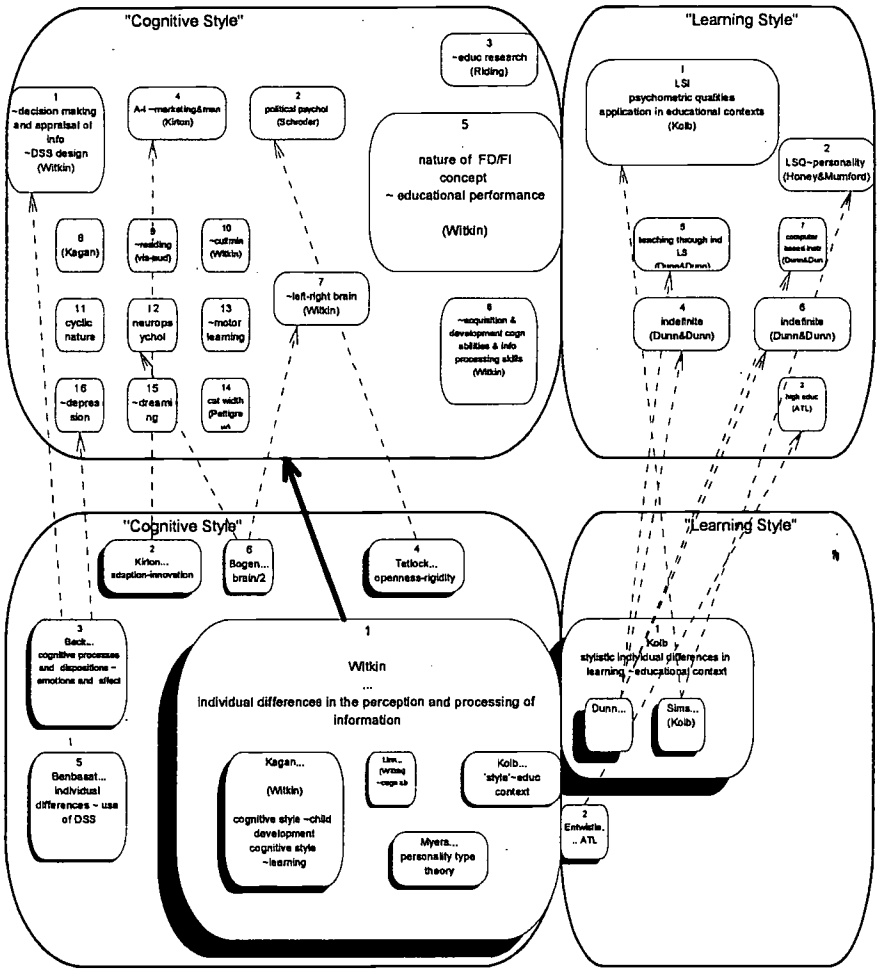
Three general conclusions about the nature of the cognitive and learning style research can be drawn from the results outlined in Figure 3.

First, it can be observed that the nature of the cognitive and learning style research is very different at a quantitative and qualitative level. The cognitive style research field is larger and much more differentiated than the learning style research. The cognitive style is presented as a more generally applicable approach, for it is less specific and formulated at a more abstract level. Learning style research represents a smaller research field. Moreover, the context in which this type of research has developed is especially and foremost "education".

Second, the alternative organization also allows to point out what the research fields have in common: Witkin's heritage. It is the most dominant and the largest cluster that emerges consistently from the analyses. Next, within the large cluster of authors that build on the heritage of Witkin, there is a discernable sub-cluster (around Kolb) that applies the "cognitive style idea" within educational contexts. These authors reappear in either the learning style literature, with a specific learning style model (e.g., Kolb and Entwistle), or in the cognitive style literature, but using the original cognitive style concept within educational contexts (e.g., Riding). This helps us to conclude that we touch here upon the main source of confusion that exists in the literature between the concepts "cognitive style" and "learning style". The literature that builds on the authors that are positioned in the borderland between "cognitive style" and "learning style" often seems to use the concepts as synonyms. Nevertheless, the alternative organization of the cognitive and learning style literature as depicted in Figure 3 goes beyond this confusion and helps to maintain a position in which both concepts can clearly be identified in a specific (though interrelated) way.

Third, when the variety of models within both research fields is considered, additional conclusions can be drawn. On the one hand, the alternative organization confirms the position of a number of dominant cognitive and learning style models. This confirms the potential of co-citation analysis to build up alternative organizations, as stated in the methodology section. On the other hand, only a limited number of the 125 existing models mentioned in the introduction, re-appear in independent co-citation clusters. The other models either do not have enough scientific impact, or are too strongly related with one of the dominant models.

The Present: Publications on Cognitive and Learning Style Since 1972



The Foundations: the Authors Cited in the Cognitive and Learning Style Literature Since 1972

FINAL CONCLUSIONS

Considering the former, we can conclude that citation analysis has helped to build up an alternative organization of the cognitive and learning style literature. But further research is needed, because this application of citation analysis, next to its strengths, also has its weaknesses. We have e.g., to stress the fact that only basic bibliometric techniques have been applied. Some extra analyses and application of more advanced techniques are needed to refine the approach and to build up a refined organization of the literature. An example of the latter is the incorporation of the impact scores of the journals in which the authors publish.

One question remains to be answered. Does the alternative organization meet the requirements put forward earlier in this paper? Building on the results, we state that the answer to this question is positive:

1. Unambiguous: Citation analysis has clearly met this requirement. The assignment of a specific publication or author to a certain cluster criterion is based on a generally applicable technique: being co-cited with others.
2. Exhaustive: All the cognitive and learning style literature available from the ISI databases could be included in the analysis. However, during the analysis procedure, certain authors/publications did not meet minimum criteria (e.g., citation rate > 10). This resulted in a drop out of publications/authors with little or no impact on their research field. Readers might indicate this results again in "blind spots" in the overall organization of the literature. But, inclusion or exclusion of publications/authors was based on clear criteria that have been generally applied to all publications/authors.
3. Clear distinguishing criteria: The fact that the clusters were build up on the basis of co-citation already indicates that also this criterion has been met. The approach to build up this alternative organization is easy to replicate. New models based on new publications/authors can readily be taken into account. Again the two perspectives can be taken into account when setting up this new cycle of analysis.
4. Data about scientific impact: The fact that citation rates were used implies that the specific scientific impact of publications/authors has been taken into account.
5. Objectivity: Citation analysis proved to be an objective way to organize the literature. Neither at the level of the initial selection of the literature to be organized, nor at the level of inclusions/exclusion in organization clusters, did the researchers have an influence on the process. Only at the level of the "interpretation" of the cluster structures, is it possible that assumptions of the researchers might have been in play. But, due to the transparency of the research procedure, these assumptions can be easily tested by other researchers. Anyway, the statement of Garfield (1983) remains valid "Citation analysis is not a shortcut to be used as a replacement for thinking." (p. 371).
6. Information about the context: Citation analysis successfully generated a structure that reflects the broader context of the various cognitive and learning style models. The various clusters and the relationships between them made it possible to contextualize individual authors, publications, and models. Especially the clusters within the "foundations" part of the analysis demonstrate how the contexts of discovery of the cognitive style research and the learning style research differ from, and relate to, each other.

In general, it can be concluded that citation analysis proved to be a fruitful way to organize the cognitive and learning style literature. However, further work is required to go beyond this structural, organizational point of view. The quality of the cognitive and learning style research literature can gain from this new approach. Ultimately, the new approach might inspire research in such a way that Furnham (1995) finally gets a response to his urgent plea: the study of cognitive and learning styles finally has to start with the development of an ". . . experimental paradigm and the formulation of explanatory models and concepts." (p. 411).

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TABLES

Table 1
Citation Rates: Objections and Methodological and Interpretive Guide-Lines

Objections	Methodological and interpretive guidelines
A paper, author, or journal might be cited frequently in refutation or as a negative example.	Scientists tend to ignore inferior work that is of little importance. Work being criticized, is mostly of some importance.
A citation rate can be inflated by self-citations.	Studies show that up to 10% of all citations are self-citations. It is a common and accepted practice. If authors try to use self-citation to inflate a rate, this will be very obvious and easily detected.
A prestigious journal might draw more citations than a less prestigious one.	First, the impact factor from ISI *Journal Citation Reports* can be used to take into account this "prestige" factor. Second, studies show that the effect of journal prestige on citation counts may not be overestimated.
Methodological contributions tend to be cited more frequently than theoretical publications.	This is an objection especially raised by scientists who feel that methodological advances are less important than theoretical ones. The validity of this statement can be questioned. Second, studies show that methodological papers do not inevitably draw a large number of citations.
Citations also serve political, financial, and ego-satisfaction purposes.	Aggregating citations from different publications cancels out the impact of this type of bias.
Cronyism: researchers especially cite their colleagues.	It is true there are groups of researchers who tend to cite each other. But, if the groups consist of highly cited individual authors, they can be considered as "gatekeepers" that form an invisible "college" in a particular field or area. Cronyism is then little more than a manifestation of the power relations within the scientific field.

Obliteration: not all authors cite the obvious, classical antecedents.

...

This phenomenon is usually observed in the work of scientists whose work has become part of the main body of knowledge. However, before this takes place, the citation count and the reputation of these scientists usually reach a level that makes additional citation credits less necessary.
To take this criticism into account, evaluation of citation rates should always be made by people acquainted with the field of study.

...

Table 2
PR-MAA on Cognitive Style and Learning Style

Cognitive style		Learning style	
Author[a]	Publ. freq.	Author[b]	Publ. freq.
Sarmany, I.	12.00	Dunn, R.	3.86
Riding, R.J.	6.75	Onwuegbuzie, A.J.	3.83
Tetlock, P.E.	5.99	Geiger, M.A.	3.83
Saracho, O.N.	5.50	Katz, N.	3.50
Poole, M.E.	5.00	Furnham, A.	3.08
Sadler-Smith, E.	4.66	Atkinson, G.	3.00
Durrheim, K.	4.5	Loo, R.	3.00
Foxall, G.R.	4.16	Merritt, S.L.	3.00
Morrison, D.L.	4.00	Pinto, J.K.	2.83
Kubes, M.	4.00	Schmeck, R.R.	2.67
Schuller, I.S.	4.00	Reed, W.M.	2.53
McIntyre, R.P.	3.92	Sadler-Smith, E.	2.5
Niaz, M.	3.33	Marshall, J.C.	2.50
Miller, L.	3.00	Vermunt, J.D.	2.50
Robey, D.	3.00	Carraher, S.M.	2.00
Huteau, M.	3.00	Bozionelos, N.	2.00
Skotnikova, I.G.	3.00	Murrayharvey, R.	2.00
Davis, J.K.	2.83	Cornwell, J.M.	1.83
Paramaro, M.F.	2.58	Laschinger, H.K.S.	1.67
Tinajero, C.	2.58	Rychlak, J.F.	1.50
...		...	

Note. The decimal digits are the result of fractionalization, a counting procedure allowing to take also co-authorship into account.
Publ. freq. = publication frequency
[a]First 20 of 1460. [b]First 20 of 592.

Table 3
PR-DOCCC Cognitive Style

Cluster	No. docs.	References	Description
1	27	Huber, 1983 Blaylock, 1984 Cardy, 1984 ...	Witkin's cognitive style model (field dependence-independence) in relation to decision making and appraisal of information, with a view to application in decision support system design in the corporate sector.
2	13	Tetlock, 1983 Tetlock, 1984 Tetlock, 1994 ...	Political psychology: Schroder's cognitive style model (integrative complexity) in relation to political ideology and political decision making.
3	14	Riding, 1992 Allinson, 1996 Riding, 1997 ...	Riding's cognitive style model (wholist-analist and verbalizer-visualizer) in relation to educational variables, together with some research into a related model of cognitive style (Allinson's: intuition-analysis). The latter is mainly used in organizational contexts.
4	19	Kirton, 1986 Foxall, 1992 Foxall, 1986 ...	The Kirton adaption-innovation inventory: fundamental research and applications in marketing and management.
5	75	Globerson, 1983 McKenna, 1984 Packer, 1978 Jolly, 1984 ...	Witkin's cognitive style model: fundamental research into the nature of the concept and applied research, mainly of its relation with educational performance.
6	21	Strawitz, 1984 Annis, 1979 Kiewra, 1986 ...	Cognitive style (Witkin's model) in relation to the acquisition and development of cognitive abilities and information processing skills.
7	9	Dawson, 1977 Rapaczynski, 1979 Shedletsky, 1990 ...	Witkin's cognitive style model in relation to different exterior signs in behavior of left-right brain dominance.
8	3	Zelniker, 1977 Morrison, 1977 ...	Research into Kagan's cognitive style model (reflection-impulsivity).
9	4	Denney, 1974	Cognitive style in terms of visual and auditory preferences and its relation to elementary reading.

		Kennedy, 1978 ...	
10	4	Ramirez, 1974 Shade, 1982 ...	Research into cultural minority groups' cognitive style (Witkin's model).
11	6	Klein, 1979 Sarmany, 1983 ...	Research into the hypothesized cyclic nature of cognitive styles.
12	4	Galin, 1974 Doktor, 1977 ...	Neuropsychological and psycho physiological research into cognitive styles.
13	3	Brown, 1985 Edwards, 1985 ...	The relation between cognitive styles and motor learning.
14	3	Jurcova, 1993 Schuller, 1995 ...	Research into Pettigrew's cognitive style model (width of categorization).
15	3	Belicki, 1992 Fitch, 1989 ...	Cognitive styles and dreaming.
16	3	Parker, 1993 Rose, 1994 ...	Research into cognitive styles as a vulnerability factor for depression.

Note. No. docs. = number of documents.

Table 4
PR-DOCCC Learning Style

Cluster	No. docs.	References	Description
1	59	Cornwell, 1991 Sims, 1986 Merritt, 1984 Freedman, 1978 ...	Kolb's Learning Style Inventory: discussion of its psychometric qualities and research into its application in medical training and other educational contexts.
2	13	Goldstein, 1992 Furnham, 1992 DeCiantis, 1996 ...	Honey & Mumford's Learning Style Questionnaire: used as a point of reference to evaluate other learning style instruments on the one side and as a personality correlate on the other side.
3	6	Vermunt, 1996 GeislerBrenstein, 1996 Busato, 1998 ...	Phenomenographic research and the approaches to learning perspective on learning style, mainly in the context of higher education.
4	11	Cahill, 1984 Carbo, 1983 Rogers, 1980 ...	A cluster that is difficult to interpret. It contains publications on the learning styles of students in health professions (especially in occupational therapy), and publications on the relation between learning styles and exceptionality. Though it can be said by intuition that these contexts are more or less related, why exactly these groups form one cluster, stays unclear.
5	13	Lenehan, 1994 Dunn, 1995 Felder, 1995 ...	Cluster of publications that make a plea for, or report research into the effects of "Teaching Students Through their Individual Learning Styles" (Dunn & Dunn, 1978) using various learning style models. The Dunn&Dunn model however forms the core of the cluster.
6	10	Yong, 1992 Davenport, 1986 Katz, 1990 ...	This cluster is difficult to interpret. It can be only vaguely indicated that the Dunn & Dunn learning style model is used by most publications in this cluster and that this is mainly in special educational contexts (gifted students, educational gerontology, occupational therapy...).
7	5	Burger, 1985 Larsen, 1992 ...	Research into the relation between learning styles and the effectiveness of computer based instruction.

Note. No. docs. = number of documents.

Table 5
F-MCFA of the Cognitive and Learning Style Literature

Cognitive style			Learning style		
Author	Cit. rate	No. cit. docs.	Author	Cit. rate	No. cit. docs.
Witkin, H.A.	807	340 (1)	Kolb, D.A.	341	172 (1)
Kagan, J.	254	128 (2)	Dunn, R.*	195	77 (2)
Kirton, M.J.	249	106 (3)	Freedman, R.D.	68	41 (4)
Riding, R.J.*	246	57 (7)	Schmeck, R.R.*	65	40 (5,5)
Tetlock, P.E.*	224	37 (19,5)	Riding, R.J.	62	18 (27,75)
Beck, A.T.	110	45 (11)	Entwistle, N.J.	62	47 (3)
Messick, S.	94	82 (4)	Witkin, H.A.	57	40 (5,5)
Pascual Leone, J.	93	28 (33)	Sims, R.R.	45	32 (8)
Goldsmith, R.E.	84	31 (24)	Keefe, J.W.	45	37 (7)
Suedfeld, P.	81	18 (63)	Biggs, J.B.	44	31 (9)
Foxall, G.R.*	77	20 (53,5)	Gregorc, A.F.	42	22 (20)
Goodenough, D.R.	77	60 (6)	Marton, F.	41	28 (11,5)
Oltman, P.K.	75	64 (5)	Curry, L.	39	29 (10)
Kogan, N.	70	53 (9,5)	Furnham, A.*	39	14 (38)
Myers, I.B.	69	54 (8)	Carbo, M.	38	13 (43)
Eysenck, H.J.	66	42 (13)	Laschinger, H.K.	36	13 (43)
Piaget, J.	60	43 (12)	Myers, I.B.	35	28 (12)
Simonton, D.K.	60	6 (439)	Price, G.E.	35	27 (13,5))
Messer, S.B.	56	53 (9,5)	Atkinson, G.*	34	23 (17,5)
Gardner, R.W.	55	38 (17)	Eysenck, H.J.	33	12 (49,5)
Rokeach, M.	55	32 (22)	Merritt, S.L.*	33	27 (13,5)
Saracho, O.N.*	54	21 (49)	Vermunt, J.D.*	33	18 (27,75)
Cronbach, L.J.	50	40 (15)	Katz, N.*	30	22 (20)
...			Veres, J.G.	28	26 (15)
			Johnson, D.W.	28	11 (54)
			Honey, P.	27	25 (16)
			Cornwell, J.M.*	26	19 (24)
			Pask, G.	26	23 (17,5)
			...		

Note. Only the authors with the twenty highest citation rates are included. Between parentheses, their rank number based on the number of citing documents is added.
Cit. rate = citation rate; no. cit. docs. = number of citing documents.

Table 6
F-FACCC Cognitive Style

Cluster	No. of authors	Authors	Most cited publication
1	122	Witkin, H.A.	Manual Embedded Figures Test (1971)
		Kagan, J.	Information Processing in the Child: Significance of Analytic and Reflective Attitudes (1964)
		Myers, I.B.	MBTI Manual. A Guide to the Development and Use of the Myers-Briggs Type Indicator (1985)
		Gardner, R.W.	Cognitive Styles in Categorizing Behavior (1953)
		Messick, S.	Individuality in Learning (1976)
		Riding, R.J.	Cognitive Styles: An Overview and Integration (1991)
		Kolb, D.A.	Learning Style Inventory (1976)
		...	
In this cluster, the majority of the authors are being cited (even several times) in combination with Witkin. Although most authors listed above developed a specific style model, this cluster indicates that cognitive style researchers consider themselves as being related to Witkin's work. A plausible explanation for this is the fact that they all study individual differences in the perception and processing of information. Notice the appearance of Kolb's learning style model in this cluster!			
2	14	Kirton, M.J.	Adaptors and Innovators: A Description and Measure (1976)
		Goldsmith, R.E.	Personality-Characteristics associated with Adaption-Innovation (1984)
		Clapp, R.G.	Stability of Cognitive-Style in Adults and some Implications, a Longitudinal Study of the Kirton Adaption-Innovation Inventory (1993)
		...	
This is a cluster of authors associated with Kirton's research into the adaption-innovation cognitive style model. (→ PR-DOCCC Cluster 4)			
3	20	Beck, A.T.	Cognitive Therapy and the Emotional Disorders (1976)
		Abramson, L.Y.	Learned Helplessness in Humans – Critique and Reformulation (1978)
		Watson, D.	Negative Affectivity – The Disposition to Experience Aversive Emotional States (1984)
		Seligman, M.E.P.	Depressive Attributional Style (1979)
		Bandura, A.	Social Learning Theory (1977)
		Carver, C.S.	Origins and Functions of Positive and Negative Affect – A Control-Process View (1990)
		...	
This cluster brings together authors who relate emotions and affect to cognitive processes and dispositions (cognitive psychology). (→ PR-DOCCC Cluster 16)			
4	16	Tetlock, P.E.	Cognitive Style and Political Ideology (1983)
		Eysenck, H.J.	Principles and methods of personality description, classification and diagnosis (1964)

		Rokeach, M.	Open and Closed Mind – Investigations into the Nature of Belief Systems and Personality (1960)
		Costa, P.T.	(Five factor model of personality)
		Schroder, H.M.	Human Information Processing (1967)
		McCrae, R.R.	(Five factor model of personality)
		...	

In this cluster, authors study aspects of personality concerning the openness-rigidity in people's belief system.
(→ PR-DOCCC Cluster 2)

5	23	Benbasat, I.	Individual-Differences in the Use of Decision Support Aids (1982)
		Huber, G.P.	Cognitive-Style as a Basis for MIS and DSS Designs – Much ado About Nothing (1983)
		Zmud, R.W.	Individual-Differences and MIS Success – Review of the Empirical Literature (1979)
		Simon, H.A.	The New Science of Management Decision (1977)
		Robey, D.	Cognitive-Style and DSS Design – A Comment (1983)

These authors relate individual differences to the use of decision support aids (DSS).
(→ PR-DOCCC Cluster 1)

6	8	Bogen, J.E.	The Other Side of the Brain: II. An Appositional Mind (1969)
		Kinsbourne, M.	Eye and Head Turning Indicates Cerebral Lateralization (1972)
		Paivio, A.	Imagery and Verbal Processes (1971)
		Galin, D.	Lateral Specialization of Cognitive Mode: An EEG Study (1972)
		...	

All authors in this cluster share the idea that the brain consists of two entities with different characteristics and different functions.
(→ PR-DOCCC Clusters 7 and 12)

Table 7
F-FACCC Learning Style

Cluster	No. of authors	Authors	Most cited publication
1	57	Kolb, D.A.	Learning Style Inventory (1976)
		Dunn, R.	Teaching Students Through Their Individual Learning Styles (1978)
		Honey, P.	Manual Learning Styles (1982)
		Plovnick, M.S.	Primary Care Career Choices and Medical-Students Learning Styles (1975)
		Merritt, S.L.	Reliability and Construct Validity of Ipsative and Normative Forms of the Learning Style Inventory (1984)
		Myers, I.B.	Gifts Differing (1980)
		Furnham, A.	Personality and Learning Style: A Study of Three Instruments (1992)
		Messick, S.	The Nature of Cognitive Styles: Problems and Promises in Educational Practice (1984)
		Jonassen, D.H.	Handbook of Individual Differences, Learning and Instruction (1993)
		...	
This very broad cluster comprises authors that study stylistic individual differences in learning within an educational context. Although some of these authors developed their own learning style model, the majority is cited together with Kolb.			
2	7	Entwistle N.J.	Understanding Student Learning (1983)
		Marton, F.	On Qualitative Differences in Learning: I. Outcome and Processes (1976)
		Biggs, J.B.	What do Inventories of Students' Learning Processes Really Measure? A Theoretical Review and Clarification (1993)
		...	
In this cluster we find authors who founded the phenomenographic approach and the approaches to learning perspective on learning style. (→ PR-DOCCC Cluster 3)			

APPENDIX
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